

# Analysis of Construction Waste Management in Sangli Region, Maharashtra

Pranoti Namdev Mane, Harshad Prabhakar Gadgil

Diploma Student, Department of Civil Engineering, Government Women Residence Polytechnic Tasgaon, Maharashtra, India

Visiting Lecturer, Department of Civil Engineering, Government Women Residence Polytechnic Tasgaon, Maharashtra, India

**ABSTRACT:** Rapid growth in construction industry has increased the problem of construction waste around the world. Construction waste have become a pressing issue in many developing countries and have adverse effects on environment, economy and social aspect. This paper explores the impacts of construction on sustainable construction and contributing causes which will help the practitioners to formulate ways in avoiding or reducing waste as practice. At research level the waste generated on job site has been calculated to be regarding 100% of materials originally purchased. The main problem in India is lack of clear indicators on quantitative parameters to assess the extent of these wastes to have created an impact on the overall performance and productivity of construction industries.

Whenever some construction takes place a lots of waste is generated. The issue of reducing and recycling construction waste are important for effects on both the environmental and housing affordability along with the stress on natural resource and ill effect of the waste on ecology. Hence for rapidly developing country like India it's time now to adopt construction waste management, which is the practice of reducing the actual waste that goes to the dumpsite. Waste reduction is best mate by recycling. The efforts to reduce, reuse and recycle construction waste may save money, reduce liability, keep jobsites cleaner and conserve valuable landfill space. In this analysis we are presenting the plan of action of for the management of waste construction materials. The study together intends to make some contributions for the consolidation of the lean construction theory, through the applying of variety of its principles in apply.

**KEYWORDS:** construction waste, reduce waste, effective management, reuse, recycle.

## I. INTRODUCTION

In recent years, the number of construction projects has been increased. Rapid growth in construction industry has increased the problem of construction waste around the world. In India disposal of solid waste onto lands or landfill is still the most common method. Although this issue has been playing around the media for some time, but there are little action taken to control the waste generation. The study stated that the reason for maximum profit. In addition, contractors tend allow considerable amount of material loss or wastage on site.

The management of construction waste is important today. Appropriate use of the construction waste is a solution to the fast degradation of virgin raw materials in the construction industry. The waste generated mainly consists of inert and no-biodegradable material such as concrete, plaster, wood, metal, broken tiles, bricks, masonry etc. these waste are heavy, having high density, very often occupy considerable storage space either on road side or communal waste bin. Hence the objective of this research is to identify the construction waste generation on site, to quantify the physical waste that are generated at the construction site and to determine the construction waste management plan that have been applied in research.

'Construction waste' means any substance, matter or not it has been processed or stockpiled before being abandoned. It is a mixture of surplus material arising from site clearance, excavation, construction, refurbishment, renovation, demolition and road works.

### 1.1 Problem Statement:

Effective minimization of waste contribute to profit maximization which is the reason for the existence of most companies. Despite the serious threat waste poses to the profit objective of most firms no serious attention is to identifying factors that contribute to the increase of waste in the construction industry. The construction of roads, houses, bridges, or anything individuals or the government, involves many resources. The built up cost of these project

significantly include the cost of waste. Unfortunately, most of the contractors have failed to initiate measures to reduce the cost of waste and in turn reduce the burden they inflict on their client in form of exorbitant charges. Without reduction in waste, companies produce at high cost, incur high debts and soon folds up. Reducing waste is not limited to small or big business but also to the newly established companies be it multinational or local. The situation is again worsening when those in production do not have any idea about operations of management. This is not to say that non operations managers can not reduce waste but it is believed that the professional can do better than the non – challenges and issues involved in the generation of waste in the construction industry and how cost can be minimized if best practices are upheld in the industry and to pave the way towards finding a solution to the waste menace.

At research level, the waste generated on site has been calculable to be regarding 100% of the purchased material. Though the waste disposal prices of construction website waste kind as very little 0.5% of the entire budget of a typical home, contractor realizes that this value will considerably have an effect on their profit since contractors usually operate inside a good five-hitter margin of profit. In this analysis we are presenting the plan of action for management of waste.

### 1.2 Objectives:

1. To identify the causes and sources of wastes that are most identified in construction industry.
2. To determine the approximate amount of waste generated on site in existing scenario and practices in construction waste.
3. To find losses due generation of construction waste.
4. To find the solution to be put into effect at residential construction sites to reduce waste production.

### 1.3 Significance of Research:

To the benefits of construction practices, this research would set to be one of the preparatory efforts to encourage the construction industry.

Problem of the industry would be redefine and reassess in order to reformat a new strategy and plan for improvement in the construction practices.

This study is also used to set up some frame work for quantitative measurement on the performance and waste measurement for construction industry

## II. OVERVIEW OF CONSTRUCTION WASTE MANAGEMENT

### 2.1 Introduction

According to the new production philosophy, waste should be understood as any inefficiency that results in the use of equipment, materials, labour, or capital in large quantities than those considered as necessary in the production of a building. Waste includes both the incidence of material losses and the execution of unnecessary work, which generates additional costs but do not add value to the product therefore, waste should be defined as any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client.

Regarding the possibility to control the incidence of waste, this study admits that there is an acceptable level of waste, which can only be reduced through a significant change in the level of technological development.

### 2.2 Problems occurred due to generation of construction waste:

Construction waste is a prominent issue globally and has adverse effect on overall performance of a project as well as the society and nature. Waste can be generated in various form. The waste occurs in the form of material, time and cost losses.

1. Materials waste as a physical construction waste:

The major physical waste generated from construction activity is identify in the form of material waste like concrete leftover, demolished debris, steel scrap and others. Studies show that material waste has significant impact to the cost of the project as well as adverse impact on environment. one of the implications created from huge quantities of material waste is illegal dumping. Illegal dumping is the unlawful deposit activity of waste onto land. This unethical

activity always cause problems to the public in general and to the environment in many places around the world. Wrongly disposal of physical waste are increasing and this contributes to pollution globally. Various countries are bogged down by this issue of illegal dumping and it is very important to understand the current situation.

#### 2. Cost and time overrun as non- physical waste:

Construction industries are extremely concerned about time and cost of the project. Most of these project are having dilemma in cost and time overrun globally. The non-physical waste normally occurs during the construction process. In contrast to the material waste, non-physical waste occurs when material are not physically lost but money and time.

#### 2.3 Importance of construction waste management:

Civil engineering construction activity is always associated with new development and project. This can be a housing project, industrial infrastructure power point, docks and harbour works etc., large quantities of traditional construction materials like earths, sand, stones, bricks, cement concrete, steel, aluminium, wood are used. The demand of these material is increasing in geometric progression. Sustainable development is a commitment to finding and using resources that are renewable. With this philosophy in view, there is an urgent need for optimum reuse of building waste material available after demolition and renewal of old structures. Also other industrial and agro-waste material can be appropriately utilised in civil construction work 2, 3. Therefore the economic viability of such application along with durability of these material need further examination. An important obvious advantage is that with recycling with that stone, aggregate, bricks etc. quarrying and mining for stone, and will be reduce. Thus the earth surface can be further saved and ecological disturbance on account of this activity will be reduce. For example, raw material for brick manufacturing is totally earth based, reuse of brick means lesser possibility of removing fertile earth, soil grass cover and forestation. This will minimize environmental destruction in overall terms. With large volume of building work, and to meet its demand, it is observed that there can be large uncontrolled growth of brick kilns, contributing to environmental decay.

#### 2.4 Hierarchy of construction waste:



#### 2.5 Hierarchy of construction waste:

The waste hierarchy was originally set out in the EC formwork directive on waste and is a useful guiding principle for waste management planning. Intergraded waste management and the waste hierarchy both inspire sustainable waste management and can reduce the environmental hazard associated with waste disposal. It is therefore important for stakeholders in the waste sector to realize that an integrate approach which constantly strives to move up the waste hierarchy can be a useful tool for sustainable waste management. It spite of efforts by municipal authorities to improve waste management, most countries in the world still resort t strategies at the bottom of the waste hierarchy. In both developed and developing countries the bulk of solid waste collected by municipalities is still disposed of in landfills.

## 2.6 Construction waste management in India:

In India nearly 50% of construction waste is being reused and recycled, while the remainder mostly landfilled. In India its common practice for large construction waste project to pile waste in the road, resulting in traffic congestion. Construction waste from individual households finds its way into nearby municipal bins and waste storage depots making the municipal waste heavy, and degrading its quality for treatments such as composting or energy recovery. The Indian construction industry is highly labour intensive and has accounted for approximately 50% of the country's capital outlay in successive five.

Year plans, and projected investment continuous to show a growing trend. Out of 48 million tons of solid waste generated in India, construction waste makes up 25% annually. Rapid economic growth leading to urbanization and industrialization is generating waste, which is adversely affecting the environment. The percentage of India's population living in cities and urban areas increased from 14% at the time of independence to 27.8% projections for building material requirement by the housing sector indicate a shortage of aggregate to the extent of about 55,000 million m<sup>3</sup>. An additional 750 million m<sup>3</sup> of aggregate would be required to achieve the target of the road sector.

There is also huge demand for aggregate in the housing and sectors, but there is a significant gap in demand and supply. Estimated waste generation during construction is 40 kg per m<sup>2</sup>. Similarly, waste generation during renovation and repair work is estimated to be 40 kg per m<sup>2</sup> to 50 kg per m<sup>2</sup>. The highest contribution to waste generation comes from the demolition of buildings.

The presence of construction waste and other inert matters makes up almost one third of the total MSW on an average, but so far no notable development has taken place for using this in an organized manner. At present, private contractors remove this waste to privately owned, low-laying land for a price, or more commonly, dump it in an unauthorized manner along roads or other public land.

## III. RESEARCH METHODOLOGY

### 3.1 introduction

This chapter explains the method that we used to collect and analyse data for our research to establishment our findings. In this study, questionnaires were used as one tool for collection data for quantitative analysis. The cause for using a questionnaire is that the opinions of responded can be acquired in a structured manner. Questionnaire are the most common method used to identify the practice of companies. Although designing a questionnaire appears to be relatively simple, it is a complex process. The questions must be formulated and selected carefully and the aim of their search must continuously be borne in mind. Due to the nature of the research, it was important to ensure respondents of confidentiality with which answer would be treated as it could drastically influence the accuracy of results. This aspect therefore enjoyed a high priority during the instruction phase.

### 3.2 Selection of companies:

The first step was the Companies selection. The companies were chosen from the CREDAI Sangali and Kolhapur Builders Association website because it provides complete in formation of about 180 companies were chosen. Second, only companies doing predominantly residential construction works were chosen. According to the centre for strategy research (2006), the minimum sample size required to accurately estimating the reality in a questionnaire survey is 30 or more companies. However, according to majumdar (1991), the minimum sample size 20 is required to satisfy the condition of large sample statistics.

### 3.3 data selection:

At this phase, questionnaires were designed to collect data. The questions were created based on the concepts acquired on the reference book. They were also designed in such a way that companies did not have to spend much time to answer. The questionnaire was designed to identify and rank the most frequent waste categories present on the job site affecting the final cost of the residential projects.

Also the questionnaire was based on the waste identification survey, to rank the types of waste ( such as delays, waste materials, deterioration of material inefficient movement of workers and so on) for the top three categories, identified on the first questionnaire, according to their influence in affecting final residential construction project cost and determine their possible causes (such as poor design and specification, poor jobsite layout, unnecessary requirements, lack of control and so on).

### 3.4 method of data analysis:

The purpose of research is to see whether the waste concept have been well accepted and adopted by the local construction company for the continuous improvement in construction process.

The research is conducted through structured questionnaire which were sent to particular qualified respondent. Here, a set of 20 questionnaire were sent to the respondent. The respondent were approach through their company and firms, through direct personal contact.

This research is used to determine the general perception and action of construction activity and to determine an approximate % waste of five A class material viz. cement, sand, steel and brick and metal were 36-38% of total cost of the project is towards these materials.

In this case, causes of wastes in construction process were classified into four main categories which are:

1. Design
2. Operational
3. Material handling
4. Procurement

Here 27% waste causing elements were outline consisting of 10% design waste, 8% operation waste, 6% materials handling waste and 3 procurement waste

### 3.5 Structure of questionnaires:

The structure of questionnaires is divide into three main sections. The first section of questionnaire is with the approximate cost of wastage generated of 5 material viz. cement, sand, steel, brick and metal along with the allowable percentage of wasted which was decided upon at the time of planning of project, the second section examines the general perception and acceptance of waste causing factors by local construction industries based on the respondent's waste concepts. In this case, the respondent were asked to recognize 27 element during construction processes. There were 2 option available for the respondents and they were required to answer whether the waste element during as listed are the waste or non-wastes during construction during construction process. The last section tried to seek whether any recycling was done on site and the respondent were again given 2 options to answer which were yes or no.

### 3.6 Sample of questionnaire

This research is focused around determining the general perception and action construction personnel against wastes in construction. The questionnaire will consist of four sections, which intend to study:

1. The general waste management philosophy and the concept of construction waste in local industry.
2. The relevant sources of wastes to have significant impact on construction project.
3. Recycling practices carried out on sites. Background information.

A. Please indicate your position in the project organization

- I. Project manager
- II. Residential engineer
- III. Site engineer
- IV. Site supervisor
- V. Contractor

B. Please select the type of your project

- I. Residential
- II. Commercial

C. Please mention the party related to project

- I. Public
- II. Private



**Section A**

Percentage waste generated to your experienced and opinion.

Please indicate the approximate allowable and actual percentage of waste for the following construction material

Sr.no	Construction material	Allowable waste in %	Actual waste in%
1	cement		
2	sand		
3	Reinforcement steel		
4	bricks		
5	metals		

**Section B**

**General perception**

To your experienced and opinion which of the following item and activities can be best represented or described as “waste to construction site” please indicate X in the waste column for waste activities and for non-waste activities.

Sr.no	Activity item	waste	Non-waste
1	Design 1. Lack of attention paid on dimensional co-ordination of product. 2. Changes made to design while work is in progress. 3. Lack of attention paid on standard size available on market. 4. Designer unfamiliarity with alternative product. 5. Complexity in detail drawing. 6. Lack of information in drawing. 7. Error in contract document. 8. Incomplete contract document at commencement of project. 9. Section of low quality product.		
2	Operation 1. Error by trades		



	person and labour. 2. Accident due to negligence. 3. Damage to work done caused by labour. 4. Use of incorrect material 5. Required quantity uncleaned due to improper planning 6. Equipment manufacturing error. 7. Weather problems		
3	Material handling 1. Damage during transportation 2. Material supply in loose form 3. Inappropriate storage leading to damage or deterioration 4. Unfriendly attitude of project team and labour		
4	Procurement 1. Order in error 2. Lack of possibility of order of small quantities 3. Purchased product that do not comply with specification		

**Section C**

Recycling practices/ awareness in local industry

To experienced in the work field, please answer the following question pertain to recycling

Sr.no	Question	Yes	No
1	Is recycling considered necessary?		
2	Are you aware of the fact that recycling can be done for		



	construction debris?		
3	Is recycling of the construction waste done on site?		
4	Is the workforce educated about wastage reduction?		

**3.7 Score assignment:**

Score assignment is the process of assigning the value for each of the items. Score assignment for section B and C each positive answer assigned with 2 points and each negative answer is assigned with 1 point based on the waste categories in table.

The first step on data analysis is to rank the most frequent waste categories present in the job site affecting the final cost. The data for this phase was collected from the questionnaire. The top waste categories will be identified and the second questionnaire will be based on them. In order to evaluate the degree of influence of each type of waste a two-point scale was as follows:

1. Non-waste
2. Waste

**3.8 Data analysis and interpretation**

This chapter represent all the result obtained from data analysis pertaining to waste concepts and waste causing factors in construction process. Descriptive statics analysis and quantitative statistical analysis will be utilized to represent.

**3.9 Respondent and their organization background:**

There are descriptive analysis shows the actual profile of the responded who have eventually taken this construction waste study.

company	name
A	Deccan infra sangli
B	Anil jadhav construction sangli
C	Landge construction manerajuri
D	R. K. construction and Developers.
E	G.S. Developers
F	DIWAN construction
G	D.H.K. construction
H	s.p.construction
I	Sunshine builders

**3.10Statistic analysis result:**

This section discusses about result from spastics analysis. The segment which are in the discussion include percentage waste generated, respondent’s waste perception and lastly respondent opinion about recycling.

**A. Percentage of waste generated**

In this section A of questionnaire the respondent were asked to identify the allowable % waste and actual % waste generated on site of 5 material namely cement, sand, steel, bricks, metal. The data collection were shown in table:



	cement		sand		steel		bricks		metal	
	allow	actual	allow	actual	allow	actual	allow	actual	allow	actual
A	3	2	7	3	5	2	5	5	3	2.5
B	3	1.5	7	8	5	2	5	7	3	2
C	3	1	7	3	5	1	5	7	3	1
D	3	1.5	7	0.5	5	1	5	1.5	3	1
E	3	5	7	10	5	2	5	3	3	2
F	3	3	7	5	5	10	5	10	3	3
G	3	1	7	5	5	5	5	10	3	5
H	3	1.5	7	3	5	1.5	5	2	3	2
I	3	2	7	3	5	1	5	3	3	2
AVG	3	2.05	7	5.05	5	2.83	5	4.94	3	2.27

Table : allowable and actual percentage of waste

Material	Allowable avg. waste	Actual avg. waste	Difference
Cement	3	2.33	0.67
Sand	7	5.05	1.95
Steel	5	2.83	2.17
Bricks	5	4.94	0.06
Metal	3	2.27	0.73

Table: difference in allowable and actual waste in percentage.

From my research I introduce new product that is concrete paving block from reused and recycled construction waste materials. This paving block are economical as compared to market paving block. Also they give strength nearly equal to market concrete block. The information about concrete paving block id given below as:

Product- Concrete paving block

Name of paving block- Cosmic

Depth- 50cm

Area of paving block- 143.8 cm<sup>2</sup>

Load taken by paving block- 200 kn

Strength of paving block- 13.98 kn/m<sup>2</sup>

Proportion of material used- 1:2:4

Equipment used to perform test- compression test on UTM machine.

#### IV. CONCLUSION

By this research we know about the percentage of construction waste in India and how we effectively deal with the construction waste. Also know about why reuse and recycling is important for construction waste. Now a days no one contractor paid attention on construction waste. Unfortunately we regard that waste as unusable but in my opinion construction waste is reusable and we can made new things from waste which gives us much profit.

#### ACKNOWLEDGEMENT:

It is with great satisfaction and achievement that i have completed my research work entitled “construction waste management”. I take this opportunity to knowledge each and every one who contribute toward my research work.

First, I would like to express my sincere gratitude toward my research guide Mr.Dr. M.P.hampali , Head of applied mechanics, departmentof civil engineering, for his able assistance, timely suggestion and guidance throughout the duration of research.

I also convey my gratitude toward those who have contributed directly and indirectly.

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#### A. Author 1-



Name- pranoti namdev mane

I have completed diploma in civil engineering from government women’s polytechnic tasgaon, Maharashtra, India.

#### B. Author2-

Name- Harshad prabhakar gadgil (v.lecturer)

B.E civil engineer, lecturer at government women residence polytechnic tasgaon, Maharashtra , India.